Notes by Alexander Graham Bell, February 21, 1902

583

1902, Feb. 21 Friday At 133. Conn. Ave

<u>STRIPS 3 MM. THICK</u>

Dimensions of strip in mm. 280 × 5 × 3. Weight supported by strip without touching table in grammes as follows: —

240 not 250 gms. White Pine

250 not 260 " Walnut

260 not 270 "

270 not 280 " Cabinet Oak, Quartered Oak

280 not 290 "

290 not 300 " Hickory

300 not 310 "

310 not 320 "

320 not 330 "

330 not 340 " Ash, Maple

340 not 350 " Birch

These results do not tally with details relating to the strips 5 mm. thick shown on p. 580, but I think that greater weight should be afforded to the table on this page than to the other on p. 580, because the strips in this case were very carefully prepared by Schneider at Ballauf's, whereas, the slips 5mm. thick were intended to be #th inch thick (about 3 mm.), and so bear evidences of inaccurate manufacture. Then again, the weights supported above are accurate to 10 gms. — that is the slips would not support 10 gms. more without touching the table, whereas in the result shown on p. 580 the results were accurate only within 100 gms. That is, the strips would not support 100 gms. more than the weights noted without 584 41? Thursday touching the table.

The differences of stiffness between strips 2mm. thick and 3mm. thick is very remarkable, indicating that with thin strips of this character a very slight change of thickness makes an enormous difference in the resistance to bending.

If we take the weights supported by the 2mm. strips and compare them with those supported by similar strips 3mm. thick we find that although the thickness is only increased one half, the resistance to bending is increased about four times. The weight of each strip, of course, varies directly as the thickness. The resistance to bending seems to vary more nearly in the proportion of the cube of the thickness — it may be an even greater ratio. Compare the weakest wood noted — White Pine at 2 mm. thick and 3 mm. thick The cube of 2 is 8; the cube of 3 is 27; the weight supported by the 2 mm. strip was 60 gms. If this should vary as the cube of the thickness, then: —

$8:27::60:x$ $x=202.5$ gms.

The actual weight supported by the 3 mm., strip of White Pine is greater than this, namely 240 gms.

The error of observation is probably greater in the case of the thinner strip than the thicker.

As the weight of a strip increases directly as the thickness; and the resistance to bending in some greater 585 proportion (probably the cube) it is obvious that it would be advisable in the manufacture of a kite to use the thickest sticks consistant with proper flying weight.

I have decided to have some sticks of larger size very carefully made at Ballauf's. The results will probably be less liable to error than those obtained in the case of thinner strips. I adopt as my standard a stick 1 Metre long, having a cross section of 1 sq. cm. This size will also be of value in determining the specific gravity of the various woods. Weigh the sticks and divide by 100, and you have the weight of 1 cu. cm. of the wood, and that weight represents the specific gravity of the wood. A.G.B.

See Scientific American for 1902, Feb. 22 for the following articles: —

p. 125 Gliding Experiments by Messrs. Wilbur Wright and Orville Wright

p. 121 The Santos Dumont Air Ship No. 7

p. 121 The Ethcograph

See Also Supplement to Schentific American 1902, Feb. 22 p. 21859 Aerial Navigation Problems by Carl E. Myers.

582

The wooden strips mentioned in yesterday's notes, pp. 579 to 581 were made originally under instructions to make them #th in. square, but they turned out to be 5mm. square. It is obvious, therefore, that they were not carefully or acurately made. They probably vary slightly in their dimensions and a very slight variation of thickness will make a considerable difference in the stiffness or resistance to bending. I do not therefore consider the table on p. 580, illustrated graphically on p. 581, as reliable in all its details.

I had some wooden strips made at Ballauf's, very carefully, and I think they can be relied upon as being accurately made according to instructions. One set consist of sticks 28cm. long, 5mm. wide, and 2mm. thick In the other set the sticks have the same length and width, but are 3mm. thick. I tested the stiffness of these sticks last night when loaded in the middle.

STRIPS 2MM THICK.

Dimensions of strip in mm. 280 × 5 × 2. Weight supported by strip without touching table in grammes, as follows: —

60 not 70 gms. Cabinet Oak, White Pine

70 not 80 " Quartered Oak, Walnut

80 not 90 " Ash, Hickory

90 not 100 " Birch, Maple

446

Make of Spruce